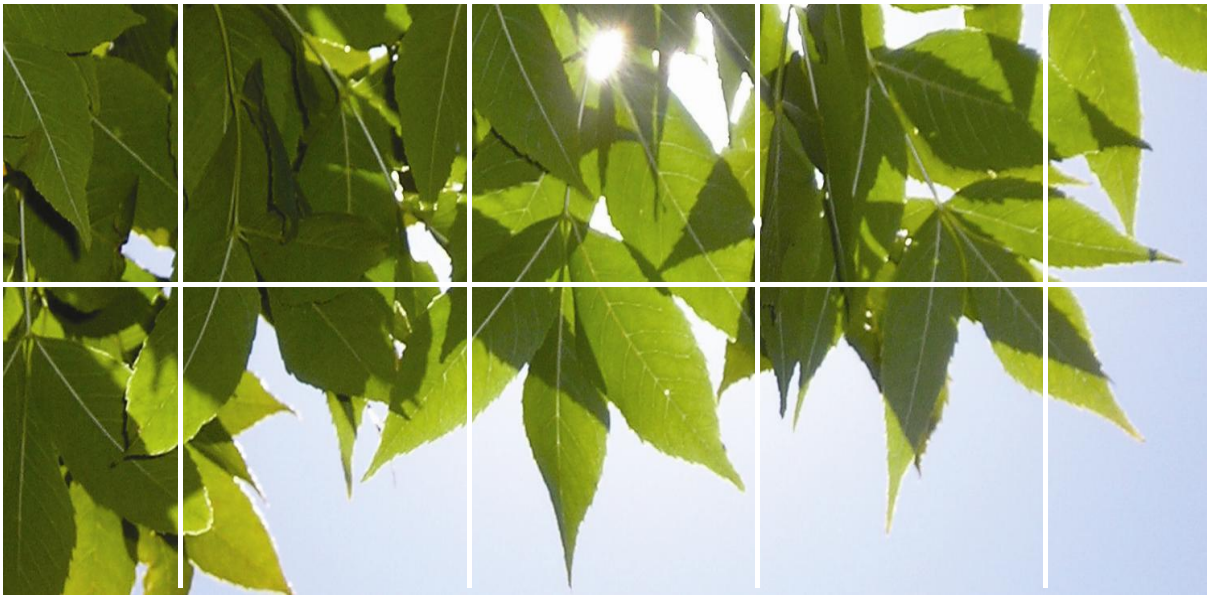
AEA

REPI and CRC: Scoping Study

Task 5 of the 2010 UK / DA GHG Inventory Improvement Programme



Report for DECC, Welsh Assembly Government, the Scottish Government and the Department of the Environment for Northern Ireland

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Executive Summary

This report summarises a review of two new energy and emissions datasets that are generated through new regulatory mechanisms:

- The **Resource Efficiency Physical Index** (REPI). These data were collected for the first time in 2010-11 by the Environment Agency of England and Wales, from all site operators that are permitted under Environmental Permitting Regulations (EPR). The data include estimates of annual energy and water consumption, site production, and waste generation.

- The **Carbon Reduction Commitment Energy Efficiency Scheme** (CRC). This is a new UK-wide emissions trading scheme that will become operational during 2011-12; a dataset from scheme participants of registration data has been made available for review.

In both cases, the data are not publicly available but have been provided for this review in order to assess their usefulness for the purposes of reporting the UK GHG inventory; where operators indicated their data are commercially confidential, these data have not been accessed in this study.

The AEA industry emission experts have reviewed the data, assessed the quality and completeness of the data, and compared aggregated data from the CRC and REPI against national energy statistics published within the *Digest of UK Energy Statistics* (DUKES), and emissions data published through the *EU Emissions Trading System* (EUETS) and the inventories of emissions from sites regulated under *Environmental Permitting Regulations* (EPR).

The study sought to identify where the new data may be useful (now or in the future) to improve the accuracy and sensitivity to policy actions of the UK and DA GHG inventories; the data may be useful to inform national and sub-national energy statistics that underpin UK and DA emission inventories as well as emission maps. Hence, the review has focussed on the geographical- and sector- resolution of the data, and the study recommendations for future research are primarily aimed at improving the completeness and granularity of reporting via these mechanisms in future.

The review has highlighted that both datasets are not directly useful for inventory emissions work at this time; further development and research is needed to make use of these new datasets due to limitations in the scope, detail, completeness and quality of the data. The completeness and quality of reporting is insufficient to enable comprehensive analysis of either dataset, and hence the analysis in this report is regarded as indicative.

The REPI data does provide energy data that are sectorally- and geographically-referenced, and the AEA experts reviewed the data to identify outliers and have estimated that the reported energy use was at least 70% consistent with other datasets such as that available from the EUETS. The REPI data do not provide complete coverage for industry sectors, but nevertheless provides a significant step forward in coverage of energy reporting within many sectors in England and Wales, as many companies under the EUETS reporting threshold do report their energy use data under REPI. The study team has recommended provision of specific technical guidance and slight modifications to the reporting template, for consideration by the Environment Agency team. It is also recommended that Scottish and Northern Irish government consider rolling-out the REPI data gathering system via the regulatory functions of SEPA and the NIEA.

The CRC data was found to be very difficult to analyse and identify benefits to energy and emissions data reporting. Data are presented by participant organisation and are not geographically-referenced. Some public sector data can be geographically-referenced. Many CRC participants operate across more than one economic sector, and hence the sector-referencing of the CRC dataset is limited. The analysis identified many instances of mis-reporting by participants, often by up to three orders of magnitude. The CRC registration dataset is therefore regarded to be of very limited use for emissions inventory work at this stage; the study team opted to focus on the public sector to perform more detailed data analysis, in order to explore the sector data that appeared to be potentially most useful from the CRC. This analysis indicates that the coverage of public sector bodies within CRC varies within the UK but that in some cases there is a high percentage of organisations reporting under CRC and therefore the data may become useful to inform de-minimis energy allocations for the public sector at DA and UK level. Meter data matching work to improve the resolution of the CRC data (by sector, by location) is being considered by DECC; it is recommended that further work to analyse the CRC data for inventory reporting awaits the outcomes from that data matching exercise, if it proceeds.

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1 Background

This report summarises the findings of Task 5 within the UK and Devolved Administration (DA) Greenhouse Gas (GHG) Inventory Improvement Programme, 2010-2011. The AEA inventory team has conducted a scoping study to investigate the detail, format, coverage and usefulness of new information on fuel use within a range of economic sectors that have arisen from new data reporting mechanisms implemented by environmental regulators.

The main aim of the study is to identify where the new data may be useful (now or in the future) to improve the accuracy and sensitivity to policy actions of the UK and DA GHG inventories; the data may be useful to inform national and sub-national energy statistics that underpin UK and DA emission inventories, and/or used within the AEA point source database work to improve the accuracy of emission mapping outputs as well as DA-level emission estimates. In addition, we have briefly considered the wider benefits (or potential benefits) of the new data, to provide new information for use by policy analysts and to improve air quality emissions inventory and mapping work.

The two sets of new data that been reviewed are:

- The **Resource Efficiency Physical Index** (REPI). These data have been collected for the first time in 2010-11 by the Environment Agency of England and Wales, from all site operators that are permitted under Environmental Permitting Regulations / Integrated Pollution Prevention and Control (EPR/IPPC). The data include estimates of annual energy consumption, by fuel type, as well as data on site production, waste generation and water consumption.

- The **Carbon Reduction Commitment Energy Efficiency Scheme** (CRC). This is a new UK-wide emissions trading scheme that will become operational during 2011-12, and for which a dataset from scheme participants of registration data has been made available to energy and emission inventory analysts.

The key criteria of interest in reviewing these new data and assessing their usefulness for inventory work are:

- The **geographical coverage** of the data, and whether the data can be **geographically-referenced** to enable use within sub-national (DA, LA, mapping) energy and/or emissions work to improve data accuracy at local/regional level;

- The **sector coverage** of the data, and whether the data can be **allocated to a specific economic sector**, to improve energy and/or emission estimates for a given emission source within the UK and ideally at local/regional level;

- Whether the data appear to be **accurate and consistent** with other datasets such as energy use data by sector available from the Digest of UK Energy Statistics (DUKES) and the EU Emissions Trading Scheme (EUETS). If so, whether this applies to specific sectors or across
- all sectors;

- Whether observed limitations in data format, detail, accuracy or consistency indicate any **priorities for further research** and/or any recommendations that could be made to the regulatory agencies to amend the current reporting systems to enable the output data to be more directly useful for local and regional emission inventories and related policy analysis.

2 Study Method

The task has comprised of a desk-based study of available data, consultation with the Environment Agency teams that are responsible for the development and regulation of the two new datasets, and email and phone follow-up with stakeholders such as DECC energy statisticians and policy leads.

The access to CRC data for the purposes of this study has been limited, as the Environment Agency has been conducting ongoing data quality checking on the participant registration data throughout January to March 2011, ahead of the collation and analysis of the first year of CRC scheme data, which is due to be reported by participants during July 2011. The CRC dataset used for this study is associated with high uncertainty. The Environment Agency team is conducting checks of participant registration data against forecast electricity estimates based on energy supplier information, and seeking to resolve any large data discrepancies through consultation with participants.

Furthermore, from meetings and email and phone consultation with CRC stakeholders (within the Environment Agency, DECC, Scottish Government and Welsh Assembly Government) it has become clear that a detailed study of the current registration data is of limited value, given the narrow scope of the current data and the lack of sector- or geographical-resolution of the CRC records. As a result of this, and to ensure cost-effective delivery of this research, more resources have been directed towards analysis of the REPI data, whilst only a limited review of the CRC data has been conducted and is presented here.

2.1 REPI Data

The Pollution Inventory (PI) team within the Environment Agency manages the compilation of the REPI data; the REPI data have been collected for one year only, as operators reported the data to the PI team alongside annual emission returns for 2009. Whilst the emissions data of the PI were published by summer 2010, the REPI dataset underwent specific quality checking routines and were not released for this analysis until early 2011.

Note that the REPI data are not published, as they are intended for use in sector-specific benchmarking graphs on the Agency's website, without individual installation data presented. Furthermore, several site operators have stipulated that the REPI data are commercially confidential, and for these sites no quantitative information from the REPI dataset has been provided to AEA. As a result, this report does not include any site-specific data or commentary, in order to protect commercial confidentiality of the data; where possible, we present aggregated sector-wide data to illustrate the study findings.

The table below outlines the data processing conducted to analyse the REPI data.

Table 2-1 REPI Data Processing Steps to Enable Analysis and Comparison against Energy and Emissions Data from other Sources

Step	***Comment***
Allocation of each site to source sectors, aligned with NAEI emissions database and AEA point source database.	The REPI data includes an allocation of more than 1600 (1682) of sites to be allocated. Of these sites 32 included no quantitative data due to commercial confidentiality, 555 sites report no gas usage, 1094 sites report no oil usage, 1609 sites report no coal usage and 1519 sites report no non-fossil fuel consumption reported. AEA can't be certain that zero usage is correct or just not reported for all sites.
Alignment of REPI data with Point source database. REPI permit IDs are used to link each line of REPI data to an AEA point sources database Plant ID.	This enables the REPI data to be quickly matched with other data available to AEA such as EUETS data as well as allowing us to use existing inventory systems to categorise each line of REPI data by, for example, region, sector, inventory source etc.

Step	*Comment*
Allocation of REPI sites to Region IDs.	The REPI data only covers England and Wales, and each Plant ID is already assigned to either England or Wales, so this is a simple query to run once the REPI sites are allocated to NAEI Plant ID, except for new sites not previously allocated within the AEA database.
Allocation of REPI sites to NAEI source codes.	There are some cases where there is a one-to-many relationship as a REPI site may comprise one or more combustion processes, as well as process (non-combustion) emission sources.
Allocation of REPI sites to DUKES energy use categories	Many of the NAEI source codes have a one-to-one relationship with the categories of fuel users in DUKES so some of this task was simple. In the case of industrial combustion plant, however, DUKES uses eleven categories that are covered by a single NAEI source code. In this case, and a few other areas, it was necessary for us to allocate REPI sites to one of the DECC categories based on our knowledge of the processes, or based on the type of process being regulated (as given by the ASR code).
Estimation of carbon combustion emissions for each REPI site. - REPI provides a breakdown of fuel use for gas, electricity, solid fuels, oils and bio-carbon sources. - AEA assumed that oil use above 10000MWh indicated fuel oil use, and below that threshold was gas oil use. - AEA used expert judgement to allocate gas use to either natural gas or other gases such as coke oven gas. Similarly, non-fossil fuels had to be based on expert judgement. - Emissions of CO_2 from the fuel use were estimated using 2009 GHGI emission factors for each fuel.	Fuel use converted into units so that GHG emission factors could be used to estimate emissions. Judgement made on specific type of fuel for gas, oil and non-fossil fuels. There will be some uncertainty in making these judgements however most of the judgements made for gas will be correct (because most gas used in the UK will be natural gas) and the uncertainty will be largely unimportant for oil (because the impact on the quality of carbon emission estimates is very low). There will be much larger uncertainties for non-fossil fuel as specific fuel types aren't as easily to identify and will range from fuels with zero fossil carbon (wood, sewage gas etc.) through to fuels with high fossil carbon (e.g. some types of waste). GHG emission factors used to calculate carbon emissions. Factors were not available for all types of non-fossil fuels, so the closest available factor was used instead.
Comparison of REPI-derived CO_2 emission estimates against EPR/IPPC and EUETS (where applicable) emissions data.	The REPI emission based on estimates of fuel consumption can be compared against IPPC and EUETS data to provide an initial consistency check. It has been assumed that the scope of the REPI reporting is the same as the scope of IPPC reporting. This allows possible inconsistencies in data to be identified. Where potential inconsistencies have been identified the Environment Agency will be provided with details so that they can review if required

The analysis conducted by AEA includes various assumptions, most notably as regards the emission factors for each fuel, and allocation to NAEI fuel type (e.g. gas oil or fuel oil). The observed differences between REPI-derived emission estimates and those from EUETS or IPPC may in some cases be down to differences in scope. For example, the REPI energy data are presented split out by electricity, gas, oils, coal and non-fossil fuels, and it is unclear whether operators would include estimates of fuels such as petroleum coke, coke and (all) biofuels within those reporting categories or whether they will have omitted this data.

Furthermore the REPI-derived estimates exclude any emissions from process-derived carbon dioxide emissions (such as from the decarbonisation of limestone and dolomite in many mineral processes), and so the direct comparison of REPI-derived emission estimates to IPPC and EUETS totals is not possible. Additional time and resources are needed to compare fuel estimates between REPI and EUETS; this may help to provide an insight into the consistency and completeness of REPI reporting for energy intensive industries such as cement kilns, but is a low priority given the good quality EUETS data already available and typically high traded percentage of these processes.

2.2 CRC Energy Efficiency Scheme Data

2.2.1 CRC Registration Data

The Environment Agency CRC team provided a dataset of registration data from all scheme participants in mid-February, and the AEA team has conducted some preliminary analysis of these data. A meeting of stakeholders at DECC, including representatives of WAG and SG, discussed the data scope and reporting format, and requested clarifications from the Agency on access to information on scheme participants and how it may be possible to develop geographically- and sector-referenced energy data from the CRC. There are ongoing discussions between DECC and the Environment Agency to explore whether access can be granted to supplementary data (e.g. from participant registration packs) and technical expertise to explore whether electricity meters can be matched to specific premises and then to specific sectors, in order to develop the CRC dataset for use in energy statistics and mapping.

The Environment Agency CRC team are conducting ongoing data quality checking, to compare the registration data (electricity use at Half Hourly Meters - HHMs - in MWhs) submitted by scheme participants against an initial estimate dataset from analysis based on energy company information. The Agency team has been identifying outlier data, following up with participants and resolving data inconsistencies.

There are uncertainties associated with the CRC Registration data that have been used for this study, and note that the CRC registration data covers a sub-set of the total CRC information that will be reported by participants in July 2011. Therefore, all of the analysis presented in this report must be regarded as indicative only. No participant-specific information is presented here, to protect data confidentiality. The analysis is presented aggregated by sector.

2.2.2 Initial Analysis of CRC Registration Data

The AEA team has used the latest (21st February 2011) CRC registration dataset for this research, and in order to obtain the most use from this data, we have explored the usefulness of the data in the one sector where geographical- and sector-referencing is generally achievable through the participant name, i.e. the public sector. The monitoring of energy use and GHG emissions within the public sector is a high priority for all levels of Government in the UK; the CRC is a new dataset that may help to improve the understanding of energy use and to identify possible opportunities for energy efficiency and/or fuel switching (e.g. to renewable fuels) to achieve emission reductions in the public sector.

2.2.3 Public Sector Analysis

The AEA team has queried the CRC data to identify:

- Local councils
- County councils
- Police forces / constabularies
- NHS Trusts / hospitals
- Universities, colleges and schools
- Central Government Departments

- Devolved Governments / Departments
- Other public sector bodies such as museums, Government agencies etc

This process identified 616 public sector CRC participants (i.e. 22% of all participants); there may be other public sector participants that have been overlooked, as the process of identifying them manually is not ideal.

Each of these 616 public sector participants was then allocated to one of the constituent countries of the UK (i.e. England, Scotland, Wales, Northern Ireland), in order to enable comparison between reported data and coverage of CRC between countries.

In some cases, where the participants are known to have sites across the UK (e.g. the Health & Safety Executive and the Crown Prosecution Service), the participant has been allocated to "all" and the electricity allocation for those participants between the 4 countries has been estimated based on the overall split of electricity consumption from DECC Energy Trends. This assumption introduces uncertainty to the public sector analysis, but the overall impact of this assumption is very small in the overall context, given the lack of certainty in the participant registration data and the small level of emissions for these UK-wide participants.

In the case of central Government Departments and agencies, the participants have been allocated entirely to England, unless they are known to be based elsewhere (e.g. ONS and DVLA in Wales), as we have assumed that the majority of Departmental buildings are London-based.

To enable analysis of the public sector coverage within the CRC, the 616 participants were allocated to the following sub-sectors:

- PUBLIC – LA (county councils, local councils and London boroughs)
- PUBLIC – NHS (NHS trusts, Primary Care Trusts, individual hospitals)
- PUBLIC – Police (Police forces, constabularies)
- PUBLIC – UK (central Government departments)
- PUBLIC – DA (Scottish and Welsh Assembly Governments, and individual Northern Ireland Departments)
- PUBLIC – Education (Universities, colleges and schools)
- PUBLIC – Other (Agencies, Commissions, Museums, Research councils etc.)

The largest sub-sectors in terms of reported electricity use are the PUBLIC – LA, PUBLIC – NHS, PUBLIC – UK and PUBLIC – Education sectors. Further research was then conducted to review the coverage of several of the main public sector sub-sectors, to ascertain the completeness of sector reporting under CRC, by country where possible. The findings are reporting in Section 3.2.

2.2.4 Analysis of Top 50 Electricity Users

In order to assess a limited sub-set of the remaining CRC Registration data, the AEA team has reviewed the participant registration data for the top 50 electricity users. The limited data quality of the dataset has been outlined above; the top 50 electricity users were identified following quality checks during which the AEA team discounted 46 participants that were assumed to have mis-reported data by a factor of 100 or 1000 due to the extremely high reported electricity use compared to the Agency's other indicative dataset from energy supplier information.

The "assumed" top 50 electricity consumers in the CRC registration dataset were then allocated to economic sectors.

To enable an initial analysis of the ease of geographical referencing of the top 50 electricity users, the AEA team used expert judgement and knowledge of the organisations to assess whether the participants would comprise of a "few" sites (where we judged the participant CRC scope to comprise 10 sites or fewer, e.g. chemical manufacturing companies) or "many" sites (where we judged that the participant CRC scope would comprise more than 10 sites, e.g. banks, supermarkets).

Sector 3.2.3 summarises the findings of this exercise, summarising the sectors that are evident in the top 50 participants, the percentage of the total reported CRC registration electricity use that the top 50 participants cover, and an indication of the ease of geographical referencing for the energy use reported by the top 50 participants.

3 Study Findings

3.1 REPI Analysis

The review of the REPI data is presented below, from an initial assessment of the data format and detail, the routine quality checks performed by the Agency and then through the AEA analysis to compare REPI data against energy data within the Digest of UK Energy Statistics (DECC, 2010) and REPI-derived carbon dioxide emission estimates with EUETS and EPR/IPPC data.

3.1.1 REPI Data Scope and Format

The REPI data is an annual dataset compiled by the Environment Agency Pollution Inventory team, based on operator returns from all EPR/IPPC-regulated sites within England and Wales. The completeness of operator reporting is very high; a small minority of site operators have requested that REPI returns be considered commercial confidential. The data cover the calendar year, and within the REPI dataset the data fields that operators provide include:

- Year
- Authorisation ID (EPR/IPPC permit number)
- Activity Schedule Reference (ASR) Code and Description (indicates main site activity)
- Operator Name, Site Address, postcode, eastings and northings, EA Region Name
- Commercial Output (MWh, tonnes)
- Raw material consumption in tonnes (gross, net)
- Energy Consumption in MWh (gross total, grid electricity consumption and production, gas consumption, oil consumption, coal consumption, non-fossil fuel[1] consumption**,** total net consumption)
- Water Consumption in m^3 (gross total water, net water use, mains water, direct abstraction)
- Waste Production in tonnes (gross total waste production, hazardous waste disposal, hazardous waste recovery, non-hazardous waste disposal, non-hazardous waste recovery, net total waste production)

Non-fossil fuel for the purposes of this report refers to waste plus renewable fuels e.g. biomass, waste chemicals, waste wood

The study analysis has focussed on the use of energy data, and has not considered the usefulness of waste, water and raw material consumption data in detail. Key messages from the review are detailed below with ticks denoting where there are positive aspects to REPI and crosses where there are areas of improvement:

- ✓ The above suite of information for each site provides a high level of detail to enable allocation of sites to economic sectors and specific geographical locations, and opens up the usefulness of the dataset for query from national down to local level across many environmental media and issues.

- ✓ In terms of emissions inventory work, the sector- and geographical- resolution makes the dataset highly useful for emissions mapping and consideration within analysis at all levels of Government from Local Authority (LA) to Devolved Administration to UK. Provided that data quality can be improved / assured, and the data made available for energy and emissions mapping, the REPI dataset could be particularly useful to improve the LA CO_2 dataset currently published by DECC and used by LAs to track progress against GHG indicators.

- ✓ The scope of the REPI data includes sites that are within EUETS, but also (for the first time) provides energy data on many industrial sites that are outside of the scope of the EUETS.

Hence the REPI dataset provides energy data for the non-traded sector across many major industrial sectors such as iron and steel, mineral processing, chemical manufacture, textiles, food and drink, paper and pulp, other manufacturing; emissions from these sites fall within the scope for devolved Government GHG emission reduction targets. Depending on the REPI data quality and availability, therefore, these data are directly useful to Welsh Assembly Government energy and industry policy analysts, and their counterparts in England, to identify opportunities for fuel-switching, energy efficiency and to track progress in uptake of renewable and waste-derived energy use over time.

✓ The REPI data may also be useful to help to develop the minor fuel-specific, sector-specific allocations at UK level within national energy statistics published by DECC within DUKES, and this would improve the accuracy of the allocations of emissions to industrial sectors and IPCC sectors in the UK GHGI, although it will not affect the overall UK GHGI totals (i.e. just the allocations). There are a range of sectors where the EUETS data are currently the "best available energy dataset" and these are taken into consideration by DECC as part of the annual DUKES Commodity Balance compilation, which underpins the GHGI at all geographical levels. However, the narrow definition of "combustion" applied in the EUETS does limit the completeness of the EUETS energy data; the REPI data will not only help to improve the coverage of energy data by including more installations than EUETS, but also in some sectors will provide a more complete picture of energy use for some installations that report to EUETS. For example, where directly-fired heaters, stenters and driers are used (e.g. in paper & pulp manufacture, some non-ferrous metal processes, some chemical processes), the REPI energy data should include the fuel for these combustion processes, whereas the EUETS does not.

✓ The insight into fuel-specific energy use by site could be used to significantly improve the energy and emissions mapping within the UK, to improve the accuracy (and local sensitivity to policy impacts) of estimates for a wide range of pollutant emissions to the atmosphere including GHGs as well as air quality pollutants such as NO_X, SO_2, PM_{10} and heavy metals. The reporting of pollutant emissions to the Pollution Inventory is governed by reporting thresholds for annual estimates, and hence many sites do not report all pollutants if they are below the Agency's PI reporting threshold. In emissions mapping work, therefore, the Inventory Agency has historically made estimates of energy use by fuel type for these sites in order to generate estimates of species such as heavy metals. The REPI data will be useful to over-write these assumptions and aid the generation of more accurate local emission maps.

✓ The REPI data could also help to improve other UK emission inventory datasets such as the UK Air Accounts published by ONS. The Air Accounts includes a highly detailed breakdown of emissions by economic sector, and the REPI data could be used to check or even improve that breakdown.

✓ The REPI data provides (for the first time) site-specific insight into electricity within industrial sectors; the EUETS and Climate Change Agreement data do not provide such a level of detail. These data could be useful to greatly improve the understanding of electricity use by different end-user sectors, which is a key element of some GHG reporting mechanisms (such as the WAG Climate Change Strategy reporting against reduction targets).

× The overall coverage of the REPI data is limited to all EPR/IPPC sites in England and Wales. Equivalent data from Scotland Northern Ireland are needed to provide a comprehensive UK-wide picture at this level of detail. If these data were to become available, then a more comprehensive picture of energy use within specific industrial sectors would become available to supplement (and challenge) the DUKES Commodity Balance tables, which are constructed based on periodic surveys rather than annual data returns.

× The combined reporting of waste and renewables under "non fossil fuels" reduces the transparency and usefulness of the dataset to track site-specific use of these different energy sources, and also limits the scope for detailed quality checking of the dataset; the AEA team has developed initial estimates of carbon dioxide emissions for each site in the REPI dataset, based on the fuel-specific information, but it is impossible to generate highly certain estimates

of carbon dioxide from this non-fossil-fuel data, without additional information. For some sites, such as landfill sites or sewage treatment works, it is possible to make confident judgements about non-fossil fuel use i.e. it is likely to be landfill gas and sewage gas respectively at these kind of sites. But for many other sites, particularly those engaged in manufacturing, any one of a number of different fuels might possibly be used, and indeed there will be some sites that use a range of wastes and/or renewable fuels. Furthermore, the AEA industrial emissions team is aware of several sites that we know use biofuels where the REPI data do not indicate this, which suggests some inconsistent reporting within this "non fossil fuels" field.

- The reporting format and supplementary operator guidance is not definitive for some fuel types that are important sources of emissions (GHGs and AQ pollutants) within several sectors. For example, there is no specific mention within the guidance of how to report use of petroleum coke, coke, LPG and refinery gases / other petroleum gases. Therefore it is seemingly left to the operators discretion as regards whether to include energy use estimates for such fuels, and if so where to allocate the fuel use. It is likely that some operators may report coke and petcoke use within either the "coal" (for coke) and "oil" (for petcoke) fields, whilst LPG and OPG/RFG are probably included within "Gas" data, but it is not certain that this is consistently the case, and this limits the usefulness of the REPI data.

3.1.2 Routine QA/QC of the REPI Data

From consultation with the REPI / PI team at the Environment Agency (Personal Communication: Richard Clarke, 2011) , we understand that the first year of REPI data collection and quality checking has been a challenging process; further development of REPI quality assurance systems may be implemented during 2011 as a review of the current system is scheduled for spring/summer. The 2010 dataset is currently being compiled and already a high response rate is evident; review of the second year of REPI data will undoubtedly move the data quality forwards considerably, through consistency checks against the reported data for 2009.

The Agency has indicated that for some sectors the REPI reporting metrics may need to be revised to ensure that the data are more relevant to the specific industries and generate more useful sector-wide outputs.

The first year of REPI data were reviewed by Environment Agency industrial regulation experts within the Pollution Inventory team to identify outliers within the core dataset. In the absence of previous data for many sites, this is inevitably a very challenging task, especially to identify under-reporting of REPI parameters (as over-reporting leads to obvious spikes within a sector dataset).

3.1.3 Comparison of REPI Data against DUKES, EUETS and EPR/IPPC Data

As outlined in section 2.1 above, the AEA team has performed a series of data management steps to allocate sites and fuels and apply assumptions on fuel type and emission factors, to generate emission estimates that enable comparison of REPI data against installation emissions data within EUETS and EPR/IPPC inventories. In addition, the study team has compared REPI energy data against sector allocations within UK energy statistics within DUKES.

The analysis of the REPI energy data is evidently a very resource-intensive process; the study team notes that it is not easy to identify groups of similar processes, where the relationship between REPI data and EUETS or IPPC emissions data is consistent and clear. The analysis has in many cases led to considering many sites in isolation to determine the key issues affecting data consistency.

Note also that the REPI energy data are presented in net energy terms, rather than gross (as in many other datasets).

3.1.3.1 Limitations of the Analysis and Quality Checking Against other Data

First, it is useful to discuss some cross-cutting limitations to the analysis of REPI data and the quality checks through comparison of energy and emission estimates.

Uncertainties in Fuel Allocations and Operator Reporting

As outlined above, the REPI system is not definitive in how operators should report use of some fuels (e.g. coke, petroleum coke, refinery gases). From the analysis, it also appears likely that some operators have not reported biofuels/waste-derived fuels under non-fossil fuels as they should and some may have reported these fuels under, for example gas (in the case of biogases.). Therefore there are uncertainties over the completeness of the REPI data with regard to all fuel use, and the derived emission estimates are made more uncertain due to the possibility of incomplete and inconsistent reporting.

REPI fuels data should be reported in net energy terms, but it is possible that some operators may have confused net and gross energy data. Certainly, there are instances where differences between our carbon emission estimates based on REPI data, and carbon emissions from PI or EUETS sources were consistent with confusion of gross and net energy.

Even if reporting is complete and fuels correctly allocated to REPI categories, the carbon emission estimates that we have derived will be slightly uncertain. There are two main reasons for this. Firstly, we have used default values for the calorific value of coals used by various sectors, whereas at least some businesses within each sector may use coals that deviate significantly from those default values. This is important because the calorific value is used to generate a sector specific carbon emission factor. Secondly, as already mentioned, the nature of non-fossil fuels used at sites cannot always be guessed with any certainty and the fossil carbon content of waste-derived and renewable fuels range from high (perhaps 70-80% carbon for waste oils) to zero for biofuels. Uncertainty is far less for estimation of carbon for the gas and oil lines in REPI since the carbon content of these fuels tends to be fairly consistent.

The scope of the REPI data and the PI data are intended to be the same, at least in the sense that both sets of data should apply to the same permitted process. But there will still be differences in terms of what is included in the carbon emissions derived from the REPI data, and carbon emissions reported in the PI:

- We have only included fossil carbon from use of fuels in the estimates based on REPI
- The PI includes emissions reported separately for ‘carbon from renewable sources’ and carbon. It is not certain whether ‘carbon’ is intended to include or exclude carbon from renewable sources, and nor is it certain how consistent the reporting by operators would be;
- The PI carbon figures will also include any emissions from processes such as cement, lime, and glass production, arc furnaces, aluminium smelting.

The EUETS data provide a further set of variables since EUETS permits can differ in scope to the IPPC permits that are the basis of REPI and the PI. EU ETS emissions data excludes biocarbon but includes some processes. However, EU ETS permits do not cover all types of combustion devices as already described in Section 3.1.1.

Where quality checks indicate gaps or inconsistencies, this uncertainty in scope and completeness can inhibit resolution of such issues. As a general rule, we have a good understanding of the scope of EUETS and PI data for the largest combustion plant, including power stations, steelworks, refineries and cement & lime works and, in these cases, it is often relatively easy to make confident judgements about the reasons for differences. For other industrial plant, it is much more difficult

In these cases, the lack of clarity of scope means that where data gaps or inconsistencies are noted, the reasons behind the inconsistency cannot always be resolved without very resource-intensive review. The experience of working with EUETS data, however, has shown that in most cases the data inconsistencies that were identified in the first few years of the dataset can now be explained due to known differences in reporting scope, once the dataset is large enough to identify and close out the genuine mis-reports. It may be several years, therefore, before the REPI dataset is regarded as accurate enough for use in energy and emissions analysis for some sectors, but the EUETS experience has shown us that to disregard new data as “wrong” because it apparently is inconsistent with other longer-term data is not necessarily the right approach. Even very large differences between the REPI-based carbon emissions and carbon emissions reported in the PI do not necessarily invalidate the REPI data since the PI emissions could relate to processes, or use of fuels

not requested for REPI. Therefore, we have used expert judgement to judge the quality of the REPI data rather than using rigid analysis of differences between the different data sets.

One potential issue is that EUETS energy and emissions data reporting covers the most energy-intensive sites and sectors in the UK, and hence the level of operator competence in managing energy data would be expected to be high. In the REPI dataset, the "added value" is really focussed on the smaller, less energy intensive sites that are below EUETS reporting thresholds, so the level of operator expertise in energy management may be expected to be somewhat lower, so data quality could prove to be more questionable. Where conversions from fuel bills, volume or mass-based data into energy-based data (i.e. MWh) are needed, the potential for reporting errors is high.

REPI Energy and Emissions Data Quality Assessment

The AEA team of industrial emissions experts has reviewed the REPI data, derived estimated carbon dioxide emissions from the REPI energy data, and then compared those REPI-estimated emissions against operator-reported emissions from the Pollution Inventory and also from EUETS. In some cases there is close consistency between the data, whilst in others there is not. Using expert judgement and site-specific knowledge, the AEA team has then assigned each REPI energy data record to one of 5 data quality ratings, as indicated in Table 3.1 below.

Table 3-1 REPI Data Quality Descriptions (as assigned by the AEA study team)

Data Quality Rating	***Description***
A	REPI data considered as correct with minimal errors
B	REPI data is not totally consistent with other datasets, however is considered as reasonably accurate
C	REPI data is not totally consistent and there are some limited concerns relating to the data
No Rating Possible	Insufficient EPR/IPPC/EU-ETS data to compare with REPI data.
Rejected Data	Data considered as inaccurate due to poor reporting or inaccurate conversions in the data submission

Table 3.2 summarises how many REPI sites correspond to each of the data quality criterion, and the sum of carbon dioxide (quoted "as carbon") for each of the data quality criteria.

Table 3-2 Data Quality Ratings for REPI Data in 2009, and the Estimated Total Carbon that correspond to each of the Data Quality Ratings.

Data Quality Rating	***Number***	***Total Estimated Carbon (kt)***	**% of Total Estimated Carbon (kt)**	**% of Total Estimated Carbon (kt) excluding "rejected data"**
A	168	31144	5%	72%
B	168	1600	0%	4%
C	113	9496	2%	22%
No Rating Possible	1190	963	0%	2%
Rejected Data	43	574436	93%	(data removed)
Sum	1682	617638		

The REPI data for 2009 which has been reviewed on the basis of the data quality has been presented in Table 3-2 above. It is apparent from the review of the data that a large proportion of the data (1190 of 1682 sites) is considered as “No Rating Possible” this is due to the lack of comparable information on carbon emissions in either PI or EU ETS. Only in the case of 43 sites were data considered poor enough to be rejected – this is just 2.5% of sites. However, because some of the data were rejected because they looked like very large overestimates of fuel consumption, the carbon emissions for the rejected data made up a large proportion (92%) of the total carbon estimated using the REPI data. This is simply due to the fact that a handful of the overestimates were sufficiently high to dominate the carbon estimates. Once the rejected data are removed, then a more realistic picture emerges of the proportion of carbon emissions in each quality class. Almost three quarters of the carbon emissions are then the highest quality, and only 2% of carbon emissions cannot be rated, although this emission is from 71% of the sites. So while the fuel totals would appear to be of good quality, being dominated by the highest quality data, it is difficult to assess the general level of quality in reporting since we cannot judge the quality of data from the majority of sites.

It should be noted that it is far harder to spot sites that may have significantly underestimated their fuel use so the above analysis may underestimate the level of questionable data. Interestingly, the rejected sites included a mixture of large EU ETS sites as well as non-ETS sites, suggesting that permitting under EU ETS may not provide any greater guarantee of quality data in REPI.

It was decided that the data points that were rejected would not be used in the assessment of the data. As indicated previously in the report the data has been rejected on the basis of expert judgement mainly due to erroneously large values being reported. In some cases it might have been possible to use EUETS or PI data to suggest ‘corrections’ to the rejected data, but this has not been done.

3.1.3.2 Comparison of REPI Coal, Gas and Oil Data against DUKES Energy Data

Note: The number of significant figures used in the data above should not be considered to be representative of the data accuracy; the REPI data should be considered as indicative only.

Table 3-5 below show a comparisons of fuel use reported by REPI (excluding rejected data) with that reported in the 2009 data from DUKES commodity balance tables specifically the use of coal, oil and gas. The table gives both the absolute value for fuel use, but also shows what percentage the REPI reported data is compared to the figures given in the DUKES commodity balance tables. It should be noted that the REPI data only relates to England and Wales whereas the DUKES data covers the UK.

The absence of data for Scotland and Northern Ireland, plus the absence of data for smaller processes not permitted under IPPC mean that we should not expect that REPI data would agree with data from DUKES. However, we anticipated that for some process sectors we might see 80-90% of DUKES fuel use reported in REPI. This is on the basis that Scotland and Northern Ireland may have only 10% of the UK carbon usage for each sector, and that some sectors would be dominated by processes regulated under IPPC. Sectors where good agreement might be expected would include Petroleum Refineries, Iron and Steel, Major Power Producers, Non-ferrous Metals and Chemicals. Other sectors such as Paper, Printing and Publishing and Heat Generation were also expected to show fairly good agreement.

GAS CONSUMPTION DATA BY SECTOR

Iron and Steel

The iron and steel sector is largely confined to England and Wales and much of the fuel use by the sector is likely to be consumed by processes regulated by the Agency. The data shows the expected good agreement between the REPI and DUKES data with >90% of the carbon being covered in the REPI data.

Heat Generation

The heat generation sector is expected to extend throughout all of Great Britain but to perhaps be less developed in Northern Ireland due to the lower availability of gas until recently. The sector is also characterised by a wide range of size of operation. Therefore, the high proportion of coverage in REPI (91%) is surprising and may indicate that some of the sites we have identified as heat generators should be classified differently, for example as auto generators.

Non-Ferrous Metals

The UK has relatively few non-ferrous metal processes, concentrated mainly in England, and fuel use is probably dominated by a number of large sites permitted in England and Wales, so it is as expected that there is good agreement between the REPI and DUKES data (83%).

Major Power Producers

The Major Power Producers sector shows fair agreement between REPI and DUKES data with 78% of the gas usage being covered by REPI data. A slightly higher proportion had been expected since relatively few gas-fired stations are located in Scotland and Northern Ireland. However, some data for major power producers were rejected, lowering the REPI figure.

Chemical Processes

Although there is a large chemical sector representation in the Grangemouth and Fife areas in Scotland, it would be expected that the fuel usage reported for this sector (48%) in REPI would be a higher proportion of the UK DUKES total. This would be expected for the following reasons:

- The majority (possibly 70%) of the processes are located in England and Wales
- The processes will be dominated by IPPC permitted processes

This low proportion compared with the DUKES data is not expected but there are some factors that may help to explain this:

- Scottish chemical sites may be more energy-intensive or likely to use gas perhaps as a result of being located to take advantage of fuels available from North Sea oil and gas terminals;
- Some chemical sites in REPI may not have been identified as such;
- DUKES may overestimate chemical industry gas use slightly. One issue here is that a number of chemical sites are served by CHP or similar plant supplying their heat and power needs. This may lead to a difference in the allocation of gas in our REPI analysis compared with DUKES.

Petroleum Refineries

REPI contains 431% of the gas use allocated to refineries in DUKES. This might indicate some errors in the REPI data but it could also reflect differing approaches to the categorisation of sites with particular issues regarding whether gas consumption is by refineries or by heat generators or autogenerators.

(Further brief comments on other sectors are included in Table 3-3 to Note: The number of significant figures used in the data above should not be considered to be representative of the data accuracy; the REPI data should be considered as indicative only.

Table 3-5*.)*

OIL AND COAL CONSUMPTION BY SECTOR

The reported data relating to the usage of Coal and Oil is thought to be more uncertain due to the calculation methodology, gas is generally metered therefore is easier to estimate usage.

As with gas usage it would be expected that the sectors of Iron and Steel, Major Power Producers, Petroleum Refineries and Non-ferrous Metals processes should have reasonable agreement between REPI and DUKES data. Use of coal for heat generation would be expected to be large-scale so present in REPI, whereas the opposite is likely to be true for oil with small scale use of gas oil in turbines and engines.

Iron and Steel

REPI figures for oil and coal are 48% and 65% of DUKES totals respectively. The figure for coal would be expected to be higher since usage of this fuel would be expected to occur mostly at IPPC-permitted sites in England and Wales. Some coal may be burnt at numerous small ferrous foundries, but the total tonnage was expected to be small.

The oil figure in REPI is lower, probably because oils are not a major fuel at large steelworks and may find more usage at smaller sites in furnaces etc.

Non-Ferrous Metals

The proportion of the DUKES total covered by REPI for oil and coal in this sector are 9% and 19% respectively. This is likely to reflect the fact that one very large user of coal is classed as an autogenerator (see below) while most other large non-ferrous sites use coke and/or gas. Other users of coal and oils may be small sites such as foundries which are not regulated by the Agency.

Major Power Producers

The proportion of the DUKES total covered by REPI for oil and coal in this sector are 83% and 86% respectively. This might be expected given the nature of the industry, their experience of reporting and the near 100% proportion of IPPC permitting in this sector.

Autogeneration

REPI includes 84% of UK coal usage by autogenerators. Fuel use in this sector is dominated by one site which is permitted by the Agency so this high proportion is expected. REPI did not appear to contain any data on oil usage by autogenerators but oil-fired autogenerators are likely to be small and/or difficult to identify so this low proportion is also expected.

Heat Generation

As with autogeneration, REPI contains a high proportion of UK coal use for heat generation and a low proportion of oil use. This is for similar reasons as for autogeneration – the coal figures are dominated by a small number of sites which the sites using oils are probably small, using gas oil in small CHP plant.

Table 3-3 to Note: The number of significant figures used in the data above should not be considered to be representative of the data accuracy; the REPI data should be considered as indicative only.

Table 3-5 has comments relating to each sector.

Overall there is better agreement in the sectors that are more heavily regulated under IPPC/EPR, as would be expected.

Table 3-3 Comparison of Gas Usage reported by REPI and by DUKES by sector, 2009

Sector	REPI Gas Use (Mth)	DUKES Gas Use (Mth)	Gas use REPI / DUKES (%)	Comments
Agriculture	21	63	34%	Many processes not under IPPC
Air transport	6	0		Dukes could be underestimating
Autogenerators	0	1038	0%	Difficult to identify-
Chemicals	420	878	48%	Most chemical processes likely to be permitted. Review of this difference should be investigated.
Commercial	0	997	0%	Many processes not under IPPC
Electrical engineering etc.	54	111	48%	Some processes not under IPPC
Food, beverages etc.	355	684	52%	Wide range of processes including both big and small
Heat generation	764	843	91%	Good agreement
Iron & steel	173	187	92%	Good agreement
Major power producers	8717	11116	78%	Reasonable agreement
Mechanical engineering etc.	23	220	10%	Many processes not under IPPC
Mineral products	210	513	41%	Permitted processes often don't use gas (e.g. cement) while non-permitted do (plaster, glass)
Miscellaneous	494	513	96%	Good agreement
Non-ferrous metals	70	84	83%	Good agreement
Oil & gas extraction	194	2085	9%	Mostly offshore – not permitted by Environment Agency
Other energy industry (including gas production)	549	2085	26%	Many processes not under IPPC
Other industries	45	274	16%	Many processes not under IPPC
Paper, printing etc.	261	473	55%	Reasonable agreement- Scotland may have high number of paper and printing processes
Patent fuel manufacture	5	0		-
Petroleum refineries	578	134	431%	Possible over estimation in REPI or difference in reporting scope
Public services	18	1263	1%	Many processes not under IPPC
Textiles, leather etc.	14	176	8%	Many processes not under IPPC
Vehicles	54	246	22%	Many processes not under IPPC
Sum of above	12573	24104	52%	Reasonable agreement, given that many gas-users will not be regulated under IPPC
Sum of Dukes Demand		34383		

Note: The number of significant figures used in the data above should not be considered to be representative of the data accuracy; the REPI data should be considered as indicative only.

Table 3-4 Comparison of Oil Usage reported by REPI and by DUKES by sector, 2009

Sector	REPI Oil Use (Kt)	DUKES Oil Use (Kt)	Oil use REPI / DUKES (%)	Comments
Agriculture	20	161	13%	Many processes not under IPPC
Air transport	1	0		Dukes could be underestimating
Autogenerators	0	137	0%	-
Chemicals	41	146	28%	Most chemical processes likely to be permitted is DUKES over estimating usage?
Commercial	0	334	0%	Many processes not under IPPC
Electrical engineering etc.	7	38	17%	Some processes not under IPPC
Food, beverages etc.	137	242	57%	Wide range of processes including both big and small
Heat generation	3	57	5%	Poor agreement
Iron & steel	102	214	48%	Reasonable agreement
Major power producers	511	617	83%	Good agreement
Mechanical engineering etc.	0	81	0%	Many processes not under IPPC
Mineral products	25	170	15%	Permitted processes often don't use gas (e.g. cement, lime) while non-permitted probably do (glass, aggregates)
Miscellaneous	26	209	12%	-
Non-ferrous metals	4	43	9%	-
Oil & gas extraction	4	0		-
Other energy industry (including gas production)	140	0		
Other industries	1	1703	0%	Many processes not under IPPC
Paper, printing etc.	5	57	9%	Poor agreement, perhaps partly due to the relatively high Scottish share of this economic sector.
Patent fuel manufacture	0	0		-
Petroleum refineries	480	685	70%	Good agreement
Public services	1	345	0%	Many processes not under IPPC
Textiles, leather etc.	0	85	0%	Many processes not under IPPC
Vehicles	3	96	3%	
Sum of above	1369	5258	26%	Poor agreement
Sum of Dukes Demand		28020		

Note: The number of significant figures used in the data above should not be considered to be representative of the data accuracy; the REPI data should be considered as indicative only.

Table 3-5 Comparison of Coal Usage reported by REPI and by DUKES by sector, 2009

Sector	REPI Coal Use (Mt)	DUKES Coal Use (Mt)	Coal use REPI / DUKES (%)	Comments
Agriculture	<0.001	0		-
Air transport	0	0		-
Autogenerators	1.2	1.4	84%	Good agreement
Chemicals	0.0	0.093	0%	-
Commercial	0.0	0.049	0%	-
Electrical engineering etc.	0.0	0.0046	0%	-
Food, beverages etc.	0.014	0.048	28%	Poor agreement
Heat generation	0.32	0.46	69%	Reasonable agreement
Iron & steel	3.8	5.8	65%	Reasonable agreement
Major power producers	32.9	38.3	86%	Good agreement
Mechanical engineering etc.	0.0	0.014	0%	-
Mineral products	0.58	1.08	54%	-
Miscellaneous	0.0068	0.0026	268%	Minor source.
Non-ferrous metals	0.0053	0.028	19%	Minor source.
Oil & gas extraction	0.0	0.0		-
Other energy industry (including gas production)	0.014	0.0		-
Other industries	0.0	0.19	0%	-
Paper, printing etc.	0.0	0.12	0%	-
Patent fuel manufacture	0.0	0.34	0%	-
Petroleum refineries	0.0	0.0		-
Public services	0.0	0.024	0%	-
Textiles, leather etc.	0.0	0.069	0%	-
Vehicles	0.0	0.046	0%	-
Sum of above	38.9	48.1	81%	Overall good agreement
Sum of Dukes Demand		48.8		

Note: The number of significant figures used in the data above should not be considered to be representative of the data accuracy; the REPI data should be considered as indicative only.

3.1.3.3 Comparison of REPI Electricity Use Data against DUKES

Table 3-6 below show the REPI reported electricity usage compared to that reported by DUKES by sector. It should be noted that as with the gas, oil and coal usage figures it wouldn't be expected that the figures should match as the DUKES data is for the UK where as REPI data only includes data form England and Wales. In addition REPI data does not include any non-permitted processes.

Table 3-6 Comparison of Electricity Usage reported by REPI and by DUKES by sector, 2009

Sector	England electricity data, REPI (MWh)	Wales electricity data, REPI (MWh)	England and Wales electricity data, REPI (MWh)	DUKES electricity data (MWh)	REPI / DUKES (%)
Agriculture	2,959,742	32,814	2,992,556	3,766,019	79%
Air transport	5,171	-	5,171	-	
Chemicals	11,283,628	374,475	11,658,103	17,188,648	68%
Commercial	86,777	-	86,777	70,191,138	0%
Electrical engineering etc.	2,815,345	4,676,063	7,491,409	6,367,356	118%
Food, beverages etc.	30,380,540	307,899	30,688,439	10,659,479	288%
Gas production	1,147,377	8	1,147,384	-	
Heat generation	1,419,860	1,412	1,421,272	16,474,298	9%
Iron & steel	1,800,628	2,373,303	4,173,931	4,069,802	103%
Major power producers	3,121,488	361,756	3,483,244	-	
Mechanical engineering etc.	1,964,798	18,830	1,983,628	7,401,050	27%
Miscellaneous	2,437,470	4,375,591	6,813,062	-	
Minerals products	3,253,891	4,468,167	7,722,058	6,373,983	121%
Non-ferrous metals	531,684	1,702,849	2,234,534	6,373,983	35%
Oil & gas extraction	374,490	4,564	379,054	604,670	63%
Other energy industry	33,342	-	33,342	1,647,686	2%
Other industries	243,347	67,622	310,969	19,253,662	2%
Paper, printing etc.	8,612,337	1,221,164	9,833,501	10,821,848	91%
Patent fuel manufacture	26,873	10,064	36,937	-	
Petroleum refineries	625,200	549,560	1,174,760	-	
Public services	13,619	40,328	53,947	19,073,272	0%
Textiles, leather etc.	3,304,768	996	3,305,764	2,883,504	115%
Vehicles	447,830	812,278	1,260,108	5,052,570	25%
Grand Total	75,922,299	17,128,377	93,050,676	208,821,719	45%

Note: The number of significant figures used in the data above should not be considered to be representative of the data accuracy; the REPI data should be considered as indicative only.

The analysis indicates that only 45% of the DUKES reported electricity consumption is covered by the sites reporting to REPI. The sector-specific comparisons also highlight specific reporting anomalies. For example, the data for the food and beverage sector indicates that REPI data exceeds the DUKES data by 288%, which could be an under-report in DUKES or an over-report in REPI. Both Scotland and Northern Ireland have a high share of the food and drink industries, so perhaps this is a sector that warrants further research. Other sectors that appear to need review due to potential mis-reporting are electrical engineering, mineral products and textiles. Many other sectors appear to be much lower than expected these include chemicals and the non-ferrous metals sectors that might be expected to be <80% as processes in these sectors may be highly permitted (hence reported in REPI data).

3.1.3.4 Traded and Non-traded Carbon Dioxide Emissions in England and Wales

The REPI data can be analysed to provide an estimate of carbon dioxide that is emitted at industrial sites that operate within the EUETS (i.e. in the "traded" sector) and the non-traded share of carbon dioxide for those industries in England and Wales. The data used to prepare Table 3-7 includes all data with the exception of the data that has been 'rejected' as detailed in Table 3-1.

Table 3-7 REPI Traded and Non-traded Carbon Dioxide (as kt carbon) in England and Wales, 2009

	England (ktC)	**Wales (ktC)**	**England and Wales (ktC)**
Emissions at non-traded sites	2289	145	2434
Emissions at traded sites (within EUETS)	36863	3895	40758
% Non-traded	6%	4%	6%

Note: The number of significant figures used in the data above should not be considered to be representative of the data accuracy; the REPI data should be considered as indicative only.

Table 3-7 shows that only a small proportion of REPI carbon dioxide emissions data is at sites in the non-traded sector, with 6% non-traded in England and 4% in Wales. Although these figures initially seem small, it must be noted that the traded sector includes the largest energy users and practically all sites in many energy-intensive industries (e.g. power stations and refineries), so energy use and carbon dioxide emissions from traded sites will be large, making the non-traded emissions seem small in comparison.

Comparing the REPI non-traded emission totals against the non-traded emissions for all sources in England and Wales enables the REPI data usefulness to be put into context.

When compared against the estimates for 2008 non-traded emissions for all IPCC sector 1A1 and 1A2 sources (29,400 kt CO_2 in England and 3,120 kt CO_2 in Wales) the sum of the REPI non-traded carbon dioxide corresponds to 29% and 17% for England and Wales respectively.

Note that these total non-traded figures are based on the 2008 DA GHGI inventory and hence direct comparison is not possible. It is also worth noting, however, that due to the economic downturn between 2008 and 2009, these percentage shares are likely to be under-estimates, as it would be expected that in 2009 the total non-traded emissions in England and Wales will be lower than those estimated for 2008.

It is possible to review the REPI data in more detail; this enables an assessment of the traded and non-traded carbon dioxide by sector and by region. A brief assessment of the data has been undertaken to create the tables below. These tables exclude the rejected data.

Table 3-8 Traded and Non-traded REPI Carbon Dioxide (as kt carbon) by sector in England, 2009

Sector	Total England REPI carbon dioxide (kt C)	Traded England REPI carbon dioxide (ktC)	Non-traded England REPI carbon dioxide (ktC)	Non-traded share of England REPI carbon dioxide
Agriculture	47.3	0.2	47.1	2%
Air transport	9.2	9.2	0	0%
Chemicals	636.0	323.0	313.0	15%
Commercial	0	0	0	0%
Electrical engineering etc.	77.6	19.9	57.7	3%
Food, beverages etc.	615.0	345.0	270	13%
Gas production	130	118.0	11.9	1%
Heat generation	1300	1100	204.0	10%
Iron & steel	1540	1500	39.1	2%
Major power producers	31700	31600	79.7	4%
Mechanical engineering etc.	33.7	0	33.7	2%
Mineral products (cement)	295.0	295.0	0	0%
Mineral products (glass)	1.6	0	1.6	0%
Mineral products (lime)	53.7	53.7	0	0%
Mineral products (lime); food, beverages etc.	248.0	199.0	48.9	2%
Mineral products (other)	11.5	7.7	3.8	0%
Mineral products (plaster)	66.3	65.8	0.5	0%
Mineral products or Iron & steel	13.3	13.3	0	0%
Miscellaneous	124.0	5.0	119.0	6%
Non-ferrous metals	808.0	733.0	74.8	4%
Oil & gas extraction	276.0	248.0	27.9	1%
Other energy industry	15.1	15.1	0	0%
Other industries	43.4	18.2	25.2	1%
Paper, printing etc.	339.0	149.0	190	9%
Patent fuel manufacture	5.1	0	5.1	0%
Petrochemical processes / refineries	712.0	264.0	448.0	22%
Public services	25.2	22.8	2.4	0%
Textiles, leather etc.	20.4	0	20.4	1%
Vehicles	67.8	52.2	15.6	1%
Grand Total	39200	37100	2040	100%

Note: The number of significant figures used in the data above should not be considered to be representative of the data accuracy; the REPI data should be considered as indicative only.

Table 3-9 Traded and Non- traded REPI Carbon Dioxide (as kt carbon) by sector in Wales, 2009

Sector	Total Wales REPI carbon dioxide (kt C)	Traded Wales REPI carbon dioxide (ktC)	Non-traded Wales REPI carbon dioxide (ktC)	Non-traded share of Wales REPI carbon dioxide
Agriculture	1.8	0	1.8	1%
Air transport	0	0	0	0%
Chemicals	41.9	9.9	32.0	16%
Commercial	0	0	0	0%
Electrical engineering etc.	7.1	3.7	3.4	2%
Food, beverages etc.	37.1	15.0	22.1	11%
Gas production	0.4	0	0.4	0%
Heat generation	48.4	40.7	7.7	4%
Iron & steel	1410	1350	62.8	31%
Major power producers	1750	1750	2.5	1%
Mechanical engineering etc.	0.5	0	0.5	0%
Mineral products (cement)	36.1	36.1	0	0%
Mineral products (glass)	2.9	2.9	0	0%
Mineral products (lime)	0	0	0	0%
Mineral products (lime); food, beverages etc.	0	0	0	0%
Mineral products (other)	0	0	0	0%
Mineral products (plaster)	0	0	0	0%
Mineral products or Iron & steel	0	0	0	0%
Miscellaneous	1.3	0.1	1.2	1%
Non-ferrous metals	18.5	0	18.5	9%
Oil & gas extraction	13.8	11.8	2.0	1%
Other energy industry	0	0	0	0%
Other industries	27.8	0	27.8	14%
Paper, printing etc.	49.7	34.9	14.8	7%
Patent fuel manufacture	2.6	0	2.6	1%
Petrochemical processes / refineries	571.0	571.0	0	0%
Public services	1.1	0	1.1	1%
Textiles, leather etc.	0.3	0	0.3	0%
Vehicles	14.0	13.4	0.6	0%
Grand Total	4040	3840	202.2	100%

Note: The number of significant figures used in the data above should not be considered to be representative of the data accuracy; the REPI data should be considered as indicative only.

The dominance of the emissions data for some traded sectors is illustrated in the tables, with the emission figures for major power producers, petrochemicals/refineries and iron & steel standing out. By presenting the data by sector, much more information can be obtained on the distribution of non-traded fuel use and sectors with higher levels of non-traded carbon within the REPI data set can be identified.

The REPI data set only covers sites that are regulated under IPPC and so the patterns seen in Tables 3-8 and 3-9 will not necessarily be repeated across those sites outside the scope of REPI. But the analysis does provide at least an indication of which sectors might be important. The next logical steps in a 'bottom-up' analysis of fuel use by non-traded sites would be to obtain data similar to REPI for IPCC regulated processes in Scotland and Northern Ireland and, following that, fuel data for processes regulated under LAPC in England and Wales, and similar processes in the other two regions. Data for those processes are not available currently, and even if they were, we would still lack data for the large number of small sites which are not regulated. Obtaining good data for those sites would be exceptionally difficult, so we believe that the REPI data delivers improvement to the bottom-up analysis of traded/non-traded carbon and fuel use in one of the few areas where improvement seems feasible.

The initial analysis undertaken in this very brief scoping study suggests that in England, non-traded carbon is most significant in the heat generation, food and chemical/petrochemical sectors (see Table 3-8) whereas for Wales, the key sectors are chemicals, food, iron and steel, non-ferrous metals, paper and printing and other industries sectors (see

Table 3-9).

3.2 CRC Energy Efficiency Scheme Data Analysis

The CRC registration data that have been used for this scoping study is a limited dataset, as it only contains estimates of electricity use by the scheme participants from Half Hourly Meters (HHMs). The annual reporting of energy use to be used within the trading scheme will include a wider scope of fuel use, including the participant consumption of oils, gas and solid fuels. National default factors will be applied to generate the GHG emission estimates from these energy data (Personal Communication: Paul Allen, Environment Agency, 2011).

Reporting

In the first year of the scheme, participants will submit two reports to the CRC regulators by the end of July 2011, although the full contents of these reports will not be publicly available:

- **Footprint Report.** To cover all fuel use by the participant organisation(s), including data on consumption of solid, liquid and gaseous fuels and all electricity use. This will include energy use for sites and activities that are included within other trading schemes such as EUETS and CCAs, but which may be outside of the scope of CRC.
- **Annual Report.** To cover the scope of energy use by the participants that falls under the CRC only, which is a narrower scope than the Footprint report, and will be used by the Environment Agency to calculate the CRC performance metrics and derive the annual league tables. (Note that the annual league tables will be published).

Sector Resolution

For many participants, the scope of the organisation and its economic activities within CRC can be allocated to a single economic sector; however, for some participants the range of activities within its CRC scope may cover several organisations and several economic sectors (e.g. private investment firms could own a range of organisations in different sectors, but report as one participant to CRC).

Geographical Resolution

Each CRC participant organisation will submit one annual return to cover energy use within all organisations and all sites that come under the scope of the participant, and the participant registered address is likely to be at the headquarters of the parent organisation. Therefore, the CRC data from each participant is not site-specific; further work, for example to match electricity meter IDs to specific sites, would be needed to enable the CRC data to be used to improve local and regional energy and emissions data. Even to derive a DA-level split of CRC data, additional analysis would need to be conducted, e.g. to review participant registration packs or the footprint reports (available to regulators later in 2011), but note that:

- This is likely to be very resource-intensive; and
- Registration documents and footprint reports are not required to be published under the CRC Order, and therefore access to them for energy and emissions research may not be possible.

The CRC Registration Data Used for this Study

The registration dataset contains record for 2773 scheme participants. Each line in the dataset has a participant name, CRC Registrant number, participant type and then a series of columns of data, which include:

- Claimed Settled HHM Supply (estimated annual electricity use in MWh, used by the Agency as an indicator of the expected registration data)
- Total Registered HHM Supply (i.e. the latest registration data from the participants, electricity use in MWh)
- Percentage of expected supply (= Claimed settled HHM Supply / Total Registered HHM Supply)

For the purposes of energy and emissions data analysis, it would be ideal if each of the 2773 participants could be allocated to either a Standard Industry Classification sector, or an economic

sector aligned with the industry and other classifications used within the DUKES Commodity Balance tables. There are some limitations to this – see the ***Sector Resolution*** comments above.

The AEA team conducted a limited assessment of the overall challenge to allocate CRC data to sectors, using participant names, industry knowledge and internet searches to allocate to DUKES economic sectors; it is generally possible to use the participant names and in most cases allocate the participant to a sector, but to do this manually is very resource-intensive and subject to error, especially as there are a large number of "commercial" sites that could be more accurately allocated if the SIC allocations were available, as well as several participants that operate within several sectors.

3.2.1 Emission Factors in CRC

For gas, solid and liquid fuels the CRC participants apply UK default emission factors to convert energy use to GHG emissions, as the scheme is designed to use UK organisational standards rather than apply site-specific or region-specific factors (Personal Communication, Paul Allen, Environment Agency, 2011). This is a simpler approach to that applied in the EUETS, where operators apply gas default emission factors on a regional basis to reflect the natural gas compositional variations monitored annually within the Local Distribution Zones (LDZs), or derive site-specific emission factors.

The CRC utilises published UK emission factors, as outlined in the guidance note Conversion Factors and Emission Factors, at:

http://publications.environment-agency.gov.uk/pdf/GEHO0310BRYY-e-e.pdf

The factors are mainly sourced from the 2009 Guidelines to Defra/DECC's Greenhouse Gas (GHG) Conversion Factors for Company Reporting; these factors have been selected as the preferred source because they are derived from the UK Greenhouse Gas Inventory (UK GHGI) and the measurement units are widely used and understood by energy managers.

Therefore the CRC is not going to provide any new data on UK or sub-UK fuel composition or emission factors.

3.2.2 CRC Public Sector Analysis

As outlined in section 2.2.3, the review of CRC registration participant names identified 616 public sector organisations (i.e. 22% of all participants).

Most of the 616 public sector participants was then allocated to one of the constituent countries of the UK (i.e. England, Scotland, Wales, Northern Ireland), with 10 agencies assumed to operate in all countries.

The initial analysis of public sector data reviewed the data quality for the 616 organisations and using expert judgement and comparison against other reference sources (e.g. the Public Sector Energy Campaign reporting in Northern Ireland) 12 entries were revised (2 increased by x1000, 2 decreased by x10, and 8 decreased by x1000) to generate a new assumed public sector dataset.

Note that the revisions to Registration data that have been assumed by the AEA team have been copied to the Environment Agency CRC team, in case there are data quality improvements that can be achieved from this scoping study analysis.

The overall public sector electricity data within the current CRC dataset is summarised below.

Please note that the data are associated with high uncertainty and should be regarded as indicative only; the precision to which the data are quoted are not an indication of the data accuracy.

Table 3-10 Public Sector CRC Electricity Registration Data by Sub-Set, AEA Estimates

Sector	England MWh	Scotland MWh	Wales MWh	N Ireland MWh	"All" MWh	Sector Total MWh	Sector % of Public CRC total
Public - LA	3,961,282	537,518	291,660	11,400		4,801,860	30.7%
Public - NHS	2,830,865	516,741	23,339	123,305		3,494,250	22.3%

Public - UK	2,889,993					2,889,993	18.5%
Public - Education	2,367,332	269,673	125,179	49,599		2,811,783	18.0%
Public - Other	745,950	33,211	29,572		83,228	891,961	5.7%
Public - Police	413,395	17,500		51,284	2,216	484,395	3.1%
Public - DA		88,900	23,850	150,218		262,968	1.7%
Grand Total	**13,208,817**	**1,463,543**	**493,600**	**385,806**	**85,444**	**15,637,210**	**100%**

The country share of each public sub-sector CRC electricity estimate is presented below.

Table 3-11 Estimated Electricity Usage by each Public Sub-Sector

Sector	England	Scotland	Wales	N Ireland	All
Public - LA	82.5%	11.2%	6.1%	0.2%	0.0%
Public - NHS	81.0%	14.8%	0.7%	3.5%	0.0%
Public - UK	100.0%	0.0%	0.0%	0.0%	0.0%
Public - Education	84.2%	9.6%	4.5%	1.8%	0.0%
Public - Other	83.6%	3.7%	3.3%	0.0%	9.3%
Public - Police	85.3%	3.6%	0.0%	10.6%	0.5%
Public - DA	0.0%	33.8%	9.1%	57.1%	0.0%
Grand Total	84.5%	9.4%	3.2%	2.5%	0.5%

The sum of the electricity consumption in organisations that are identified as operating in all countries was then allocated on to the individual countries on the basis of the overall sub-national electricity split for 2009, which is 78% England, 12% Scotland, 6% Wales and 4% Northern Ireland.

This leads to an overall estimates CRC public sector electricity allocation and split for the constituent countries of:

- England 13,275 GWh (84.9%)
- Scotland 1,474 GWh (9.4%)
- Wales 499 GWh (3.2%)
- Northern Ireland 389 GWh (2.5%)

In DUKES 2010, the total electricity allocation for the public administration sector is given as 19,073 GWh. The estimated CRC registration data total of 15,637 GWh represents 82% of this reported UK total for 2009.

This level of CRC coverage of the public sector total seems to be quite high, but the comparison is encouraging nonetheless, given the uncertainty in the CRC dataset due to the evident incidence of mis-reporting by participants.

To explore the data quality and coverage within the public sector, we reviewed the data in more detail for several sub-sets of the public sector participants:

- PUBLIC – LA (county councils, local councils and London boroughs)
- PUBLIC – NHS (NHS trusts, Primary Care Trusts, individual hospitals)
- PUBLIC – Police (Police forces and constabularies)
- PUBLIC – Education (Universities, colleges and schools)

Observations from the above data and subsequent query of underlying information to explore the coverage of the CRC participants within these public sector sub-sets are that:

- England hosts a high proportion of the central Government Departments, and the assumption here has been to allocate all such electricity use to England. This sector is estimated to comprise 18.5% of the public sector CRC dataset and contributes to the high overall share of the UK public sector CRC data in England of 84.9%;
- Northern Ireland share of the Local Authority dataset is low;
- This is to some extent countered by the high share of the “DA” Government share of the CRC data. The Northern Ireland Departments already have an established system of energy data reporting through the Public Sector Energy Campaign, and all of the Departments are “mandated participants” of CRC, whilst it appears that the scope of CRC data for the Scottish Government and Welsh Assembly Government may be narrower, as the sum of DA Government CRC data for Scotland and Wales is much lower than that reported for Northern Ireland;
- Coverage of Local Authorities in CRC high within Great Britain, but low in Northern Ireland. Across all authorities (county, city, borough etc) we have conducted a simple indicative quality check to simply compare the reported electricity data against the population within the council area. Although this is a crude measure, it has helped to identify possible outlier data;
- In Wales, 18 out of 22 Local Authorities are reporting within CRC, with the exceptions being generally the less populous;
- In Scotland, 27 out of 32 Local Authorities are reporting within CRC, and again the less populous authorities tend to be those outside of CRC;
- In Northern Ireland only one out of 26 Local Authorities is reporting under CRC;
- In England, all London Boroughs report to CRC, as do all of the County Councils with a few exceptions whilst all but two other local authorities report to CRC. There are some outlier data evident and some possible double-counts of county council data for a small number of city councils. All of these have been fed back to the Environment Agency for information.
- In the second most significant sub-set, that of the NHS, it is evident that the Wales shared is very low. Only one Welsh NHS Trust entry is evident in the current dataset, out of a total of at least 13 NHS Trusts in Wales;
- In contrast, the Scotland share of the NHS sector is nearly 15% which is considerably above the population share of Scotland in the UK, indicating a higher uptake of CRC there, although only 10 entries are evident out of at least 22 NHS Trusts in Scotland;
- Note that the analysis of the coverage of NHS Trusts within CRC is difficult to resolve due to the variability in approach to CRC in different regions, ranging from reporting as individual hospitals, single NHS Trusts or in some cases as aggregated NHS Trusts. Therefore comparison against lists of all NHS Trusts does not provide an accurate assessment and further work would be needed to review the scope of CRC entries in more detail;

- The inclusion of police force data within the CRC is very variable, with high shares evident for England and Northern Ireland, but low shares for Scotland and Wales. Upon further investigation of the CRC dataset, the coverage of participants is 23 out of 39 forces in England, none out of 4 in Wales, 1 out of 8 in Scotland and 1 out of 1 in Northern Ireland;
- The Education sector seems to be represented across the countries at a level that is broadly consistent with the "typical" split of DA energy use data, indicating that perhaps this sector has a fairly consistent level of uptake within the scheme across the UK (unlike the NHS data, LA data and police data, for example);
- A more detailed review of the coverage of universities under CRC shows that in England 83 out of 131 universities are included, with 11 out of 19 in Scotland, 6 out of 11 in Wales and 2 out of 4 in Northern Ireland. Additional analysis to derive an indicative benchmark of "electricity use per student" does show an order of magnitude scope in data reported, from 0.4MWh per student to 4MWh per student.

3.2.3 CRC Top 50 Participant Analysis

The AEA team derived a list of the "assumed" top 50 CRC electricity consumers based on the registration data, through a process of reviewing the highest reported data and discounting participants that appear to have over-reported.

The breakdown of overall electricity use by sector for these top 50 participants is summarised below. The allocation of the top 50 participants to economic sectors is subject to low uncertainty, as most of them are well known organisations that operate predominantly within a single economic sector. There are also several of the top 50 participants that have organisations that operate within several economic sectors, but for the purposes of this analysis we have assumed that all electricity use is within one sector. These allocation assumptions do therefore add uncertainty to the analysis.

Note that the AEA team has made around 50 revisions to participant electricity use estimates within the original Environment Agency dataset, to revise participant data to remove apparent over-reporting.

All of the CRC electricity data presented here are uncertain, and therefore this analysis should be considered as indicative only.

Our estimated total electricity use within the CRC Registration data is 129,200 GWh.

In DUKES 2010 Table 5.1, the total non-domestic electricity use in 2009 is 199,900 GWh, and hence the estimated CRC scheme coverage is 65% of the total non-domestic electricity use in the UK as reported by DECC.

The Top 50 participants in the CRC are estimated to account for 45,200 GWh, which is 35% of the total CRC scheme estimated total, and 23% of the total non-domestic electricity use in the UK in 2009.

The breakdown of the top 50 sites according to economic sector is as follows:

Table 3-12 Top 50 sites in CRC according to economic sector

Sector	Number of participants in the top 50	Total Electricity Use (GWh)	% of Top 50 Electricity Use	% of total estimated CRC electricity use
Commercial (Supermarket)	5	8134	18.0%	6.3%
Chemicals	4	6280	13.9%	4.9%
Commercial (other)	5	5105	11.3%	4.0%
Oil & Gas	4	4842	10.7%	3.7%
Water		4599	10.2%	3.6%
Iron & steel	3	4239	9.4%	3.3%
Public	2	2230	4.9%	1.7%
Food & drink	5	2194	4.9%	1.7%
Quarry & Mining	3	2083	4.6%	1.6%
Vehicles	4	1714	3.8%	1.3%
Cement	2	1190	2.6%	0.9%
Paper & Pulp	2	1149	2.5%	0.9%
Commercial (bank)	2	1018	2.3%	0.8%
Transport	1	449	1.0%	0.3%
Grand Total	**50**	**45226**	**100.0%**	**35.0%**

Note that data have been rounded from exact data in supporting spreadsheets, so there may be rounding issues in some of the percentage data.

For the top 50 participants, we assessed how many of the participants were judged to have 10 sites or fewer within CRC and how many had more than 10 sites within CRC, in order to provide an insight into the likely ease of obtaining better geographically-referenced data through direct research into these organisations.

We judged that 27 out of the 50 participants would have 10 sites or fewer, and the total electricity use of these participants within the CRC registration data was 23,730 GWh, which is 53% of the top 50 electricity use and 18% of the total estimated CRC registration data.

Of the participants that were judged to have “many” sites, the 5 supermarket chains account for 18% of the top 50 CRC electricity registration data, and over 6% of the total estimated CRC registration data.

This indicates that engaging with 32 participants to improve the geographical referencing of data would cover 24% of the total CRC data, whilst 50 participants cover 35% of the total. This leaves 65% of the CRC electricity data covered by the remaining 2,723 participants, which gives an indication of the spread of CRC data across the scheme participants; to allocate a high proportion of the total CRC energy data would require analysis of data for several thousand participants.

4 Summary and Recommendations

4.1 REPI: Discussion

The key criteria for reviewing these new data and assessing their usefulness for inventory work are: Geographical coverage, sector coverage, assessment of the data's accuracy/consistency and to identify the limitations of the data.

Geographical coverage: It is possible to assign the data at a sub-national level which will make it possible to undertake Devolved Administration and Local Authority mapping of energy and/or emissions data and to work to improve data accuracy at local/regional level.

Sector coverage: It is possible to **allocate data to specific economic sectors** which means the data could be used to improve energy and/or emission estimates for a given source within the UK and at regional/local level.

Accuracy/consistency: It has been possible to make some comparison with other datasets such as energy data from DUKES and the EU Emissions Trading Scheme (EUETS) although it is not always easy to have direct comparison due to the different reporting scope. After applying a filter to remove a few errors in the data, then analysis found that about 70% of the fuel usage was consistent with other data sets and likely to be accurate.

Limitations and priorities for further research: There are limitations of the data and associated uncertainties, which are discussed further below. Recommendations for actions/priorities are given in section 4.2.

It has been highlighted in this report that this is hard to verify the REPI data for a large number of sites, because there are no carbon emissions data in the PI or EU ETS to compare with. One future possibility is that the fuel data could be checked against other pollutants reported in the PI, for example oxides of nitrogen. This is perhaps the most suitable candidate both because it is mainly emitted as a result of combustion and not often from processes, but also because it would be relatively straightforward to select representative emission factors to convert the fuels data to REPI-based NO_X emission estimates.

Assessing the quality of the data will also become easier with additional sets of data. Consistency across years can be checked for each site allowing potentially erroneous data to be spotted more easily and patterns emerge that can help to uncover specific issues or common problems.

Where REPI data have been compared with PI and EUETS data, there are many instances where the data are different to a significant degree (we have used 5% as the definition of significant). On the face of it, this might indicate that REPI data are low quality, but in reality there are many possible explanations for differences – the inclusion or otherwise of biological carbon, the inclusion or otherwise of process-related emissions, differences in scope – and our experience from analysing EUETS data, suggests that reporting discrepancies are often resolved once more information on the scope of the data is available. This would be a resource-intensive job for a dataset as large as the REPI.

Overall, we are satisfied that, with the exception of a small number of sites with obviously erroneous fuel estimates, there were no compelling reasons to assume large-scale problems with the REPI data set and that the REPI data could therefore provide useful information on many sites for which we have previously not had any data on fuel use. These sites are, by definition, non-traded and so the REPI data set is particularly useful in that it extends our knowledge of fuel use across the non-traded part of UK fuel users. Comparison with data from 2008 suggests that it might provide data on 25% of the non-traded carbon emissions from 1A1 and 1A2 (energy production and industry), although the comparison of data from different years does introduce some uncertainty. Where REPI is less informative is on non-traded emissions among other economic sectors, such as the public and commercial sectors. This is because sites in these sectors would not be regulated by the Agency unless they had large combustion plant on site, in which case they would almost certainly already be covered by EU ETS.

As well as informing the analysis of the non-traded sector, the REPI energy data is also a potentially very valuable dataset to improve energy mapping in the industrial sector, as well as emissions mapping, Local Authority and Devolved Administration emissions datasets, the UK GHGI and NAEI and the ONS Air Accounts. The REPI dataset is also potentially useful to inform sector-specific UK energy estimates, thereby affecting the allocations of emissions to IPCC sectors, but not affecting the overall UK GHGI total.

As well as improving the energy and GHG emissions data at all levels of Government, the level of detail on site-specific fuel use will enable more detailed analysis of air quality emissions mapping, such as emissions from heavy metals, where the annual emissions by site are not high enough to be directly reported within the Pollution Inventory, and to date the Inventory Agency has had to make assumptions on the fuel source on site, to estimate emissions of such pollutants. No assessment of this has been undertaken as part of this work.

The review has not considered in detail the benefits to environmental regulation, reporting and tracking afforded by the available data on water use and waste arising and fate. The potential benefits of these datasets to improve multi-media emission release inventories of a wide range of pollutants is likely to be very high and warrants further specific enquiry. From recent work on multi-media release inventories for Persistent Organic Pollutants, the AEA inventory team notes that the water volumes from sites in specific industries (e.g. paper, textiles, chemicals) could be used to improve the current estimation models for key target POPs.

It is apparent from the review of the REPI data that although this dataset appears to have value in the identification of sectors that have a large proportion of the reported carbon usage that it will only be useful if the dataset itself if relatively complete and accurate. This scoping study has not reviewed each of the data points however has flagged data that may be in doubt.

More sector-specific detailed review would be needed to fully assess the REPI data, both to quality-check the data (e.g. to identify over-reports and under-reports) and to improve its usefulness for energy efficiency and wider policy analysis. This is likely to be resource-intensive and would mainly help to improve the quality of Local Authority datasets.

4.2 REPI: Recommendations

There are a number of recommendations that arise from the review of the REPI data, although we note the additional resource implications for several of these items:

- We suggest a meeting between the Environment Agency REPI team and the AEA industrial emissions team in early-mid 2011 to go through the analysis that we have conducted, to exchange ideas and seek to identify any systematic modifications to data collection or QA/QC techniques that may help to improve the dataset. There may be lessons that can be learned and site-specific data to consider (e.g. within the Agency's own analysis of the 2010 REPI dataset).

- The usefulness of the REPI data will only become apparent as the dataset develops in future years, to enable more quality checking and to reduce data mis-reporting. We therefore recommend that similar analysis is conducted when the 2010 REPI dataset becomes available, to examine year-to-year consistency, to develop our understanding of the quality of the data and to further explore the usefulness of non-traded data and the comparisons against DUKES.

- We recommend that future analysis could be extended to check whether use of a NOx equivalent to the carbon emission estimates developed for this scoping study, could extend our abilities to cross-check REPI data with emissions reported in the PI and elsewhere.

- We recommend that the Environment Agency considers developing the data reporting format in future years to request separate reporting for "waste-derived fuels" and "renewable fuels" from operators and/or to include a field in the reporting structure for operators to enter the fuel type using a drop-down menu to cover fuels such as: waste solvent, waste oils, solid waste, sewage gas, landfill gas, process sludges, anaerobic digestion derived gases, biomass, bio-diesel and renewables. A more detailed picture of the use of "waste-derived" and "renewable" fuels could be generated through REPI, which would be very valuable and benefit policy evaluation, tracking and reporting as the UK seeks to meet renewable heat targets, as well as improving emissions

inventories, emission mapping and modelling, and heat mapping outputs for DECC, Defra, Devolved Governments and Local Authorities.

- We recommend that the Environment Agency considers a modification to the reporting format of the REPI energy section, to enable operators to report use of "Other" fuels, to include a drop-down menu of coke, petroleum coke, liquefied petroleum gas, other petroleum gases and refinery fuel gas and to update the REPI guidance note to operators to cover the recommended protocol for reporting use of these fuels. This should help to ensure a more complete and consistent approach to reporting of this fuel use, improving the usefulness of the REPI data further.

- The provision of further guidance for operators would be useful to minimise errors in the reporting and the provision of data in original units as well as the units requested by the Environment Agency could be a useful tool for checking data quality.

- It is recommended that consideration be given to the development of equivalent datasets in Scotland and Northern Ireland, especially noting the potential for improved understanding of energy use within the non-traded industrial sector, and the cost-effectiveness of this approach given the pre-existing infrastructure of the SPRI and ISR, as well as the investment in developing REPI by the Environment Agency of England and Wales. This would improve the overall dataset for non-traded industrial policy development across climate change and air quality policy areas.

- The initial analysis presented here could be developed further to enhance the usefulness of the data for example by additional checking, correction of the rejected data where possible, and further analysis. There is considerable scope for researching the other aspects of the REPI dataset (i.e. the waste and water records) for applications within other environmental research, such as within the development of PRTR and multi-media (air, land, water) release inventories for specific pollutants such as Persistent Organic Pollutants.

4.3 CRC Energy Efficiency Scheme: Summary

Only a limited analysis of the CRC dataset has been conducted, to reflect the current status of the available registration dataset.

Summary of CRC Review Findings and Options for Further Work

Fuel scope: Currently only registration data are available, and this only includes annual electricity use estimates from participant Half Hourly Meters; full CRC data in annual returns will include a wider scope of fuel use, including solid, liquid and gaseous fuels.

- ➔ Further research is recommended to assess the usefulness of the annual participant reports under CRC, in particular to determine the usefulness of solid, liquid and gaseous fuel data for energy and emissions inventory work. The availability of new electricity data currently limits the application of the CRC data to end-user emissions inventory work. The first set of annual reports by CRC participants will become available from July 2011.
- ➔ Analysis of CRC participant registration packs and footprint reports may be useful to derive additional data other than that published within the annual dataset. However, there are legal and procedural issues regarding access to these CRC documents which the Agency will need to clarify and resolve with DECC and other stakeholders before such analysis can be conducted. We understand that information in registration packs is intended for use within CRC auditing only, whilst the footprint reports are also not intended for publication.

Fuel Quality: The CRC system uses national default emission factors for all fuels, and does not therefore provide any new data on fuel composition, as is the case within EUETS.

Coverage of organisations / sites within sectors: Not all organisations in each economic sector have to report to CRC, as the participation in the scheme is subject to meeting scheme-specific thresholds of energy use. Analysis of the public sector indicates a variable coverage of different organisations within the UK, e.g. not all local or county councils report under CRC. This limits the usefulness of the data to inform UK-wide and regional energy use estimates by sector.

Sector referencing: Currently the dataset contains no systematic way of allocating the participants to economic sectors. The Agency is looking into whether additional database queries can provide SIC codes for each participants, but this allocation is not yet available.

- ➔ The Agency is considering whether allocation of all participants to SIC codes is possible through the existing CRC dataset. If so, then further research could be implemented to determine the completeness of reporting under CRC by economic sector.
- ➔ For sectors where this analysis indicates a high level of completeness of reporting to CRC, then the CRC energy data will provide a new "bottom-up" dataset of energy use, to help augment current data used for energy and emissions analysis for policy development and tracking. For example, sector-specific data would greatly enhance the usefulness of the CRC dataset at the UK-level to assess de-minimis fuel use data (notably for electricity) for consideration within DUKES and subsequent by-source and end-user emission inventory analysis.
- × However, there are some CRC participants that cover a range of economic activities, and therefore the allocation of participants to economic sectors is not a one-to-one relationship in all cases, and this will inhibit the usefulness of CRC data for energy and emissions analysis.

Geographical referencing: The CRC is not designed to be an installation-based system, as the data are collected and reported at the organisation level. For many organisations with multiple sites, it is therefore not possible to directly allocate energy use data from CRC to Local Authorities or Devolved Administrations, limiting its use to improve local and regional emission inventories.

- ➔ For the CRC data to be useful in local and regional energy and emissions analysis (i.e. to generate more sensitive and accurate local inventory estimates), additional work is needed, e.g. to link meter references to other datasets that enable geographical-referencing to be achieved. The DECC DUKES team are considering this approach, in consultation with the Environment Agency. The access to CRC data needs to be clarified, in case there are legal barriers to using the CRC data for such purposes.
- ➔ For organisations with multiple sites (e.g. supermarket chains), disaggregated fuel use data by site may be available through query of underlying participant datasets such as registration packs or footprint reports. It is recommended that the Agency and/or DECC considers requesting (voluntary) provision of additional information by such scheme participants, prioritising these requests to address the highest energy users first.

Data Accuracy: The CRC registration dataset contains data reporting errors and is therefore subject to uncertainty. In the analysis of the public sector CRC data, the AEA team has identified several instances of participants mis-reporting data by several orders of magnitude and we have fed this information back to the Agency team. The CRC registration data is reported in MWh, whereas several operators appear to have reported either kWh or GWh.

In the early stages of such a new data reporting mechanism it is to be expected that mis-reporting by participants will occur, due to errors in use of units, use of conversion factors, from typographical errors and so on. The ongoing data quality checking by the Environment Agency team is expected to help identify and resolve the largest data reporting errors in consultation with scheme participants, ahead of the first year CRC reporting submissions.

Until the CRC dataset is larger, with data reporting teething troubles reduced and the expertise of participant energy managers honed to the CRC reporting requirements, the usefulness of the data for inventory work is expected to be low; from the EUETS experience, we expect that several years of CRC data may be needed before the data are considered of good enough quality to use directly in energy and emissions analysis.

Where systematic data reporting errors are identified, it is recommended that the Environment Agency drafts supplementary guidance or case studies to help participants to resolve these issues within future CRC submissions.

5 Acknowledgements

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